Wind energy: Trends and development

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Wind Energy: Trends and development

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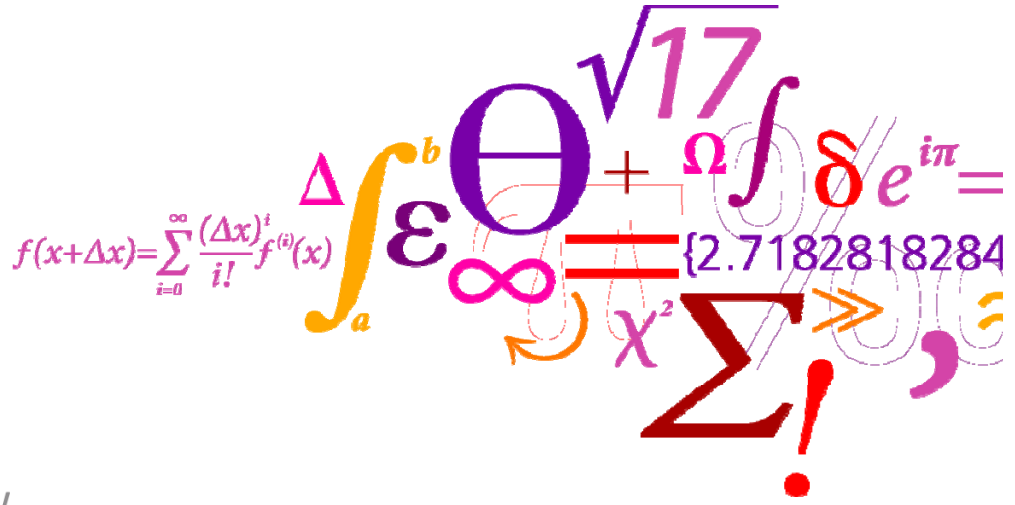
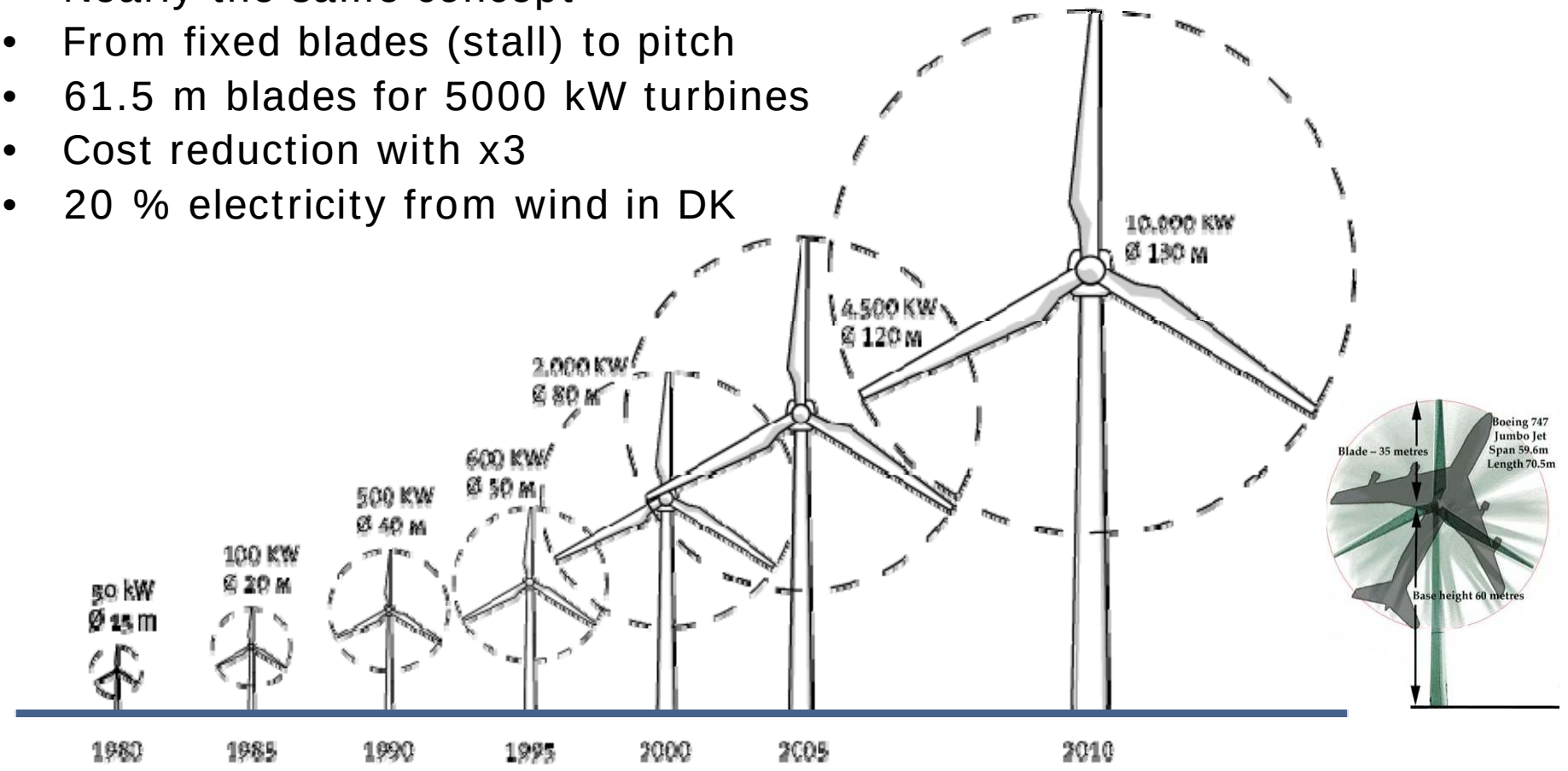


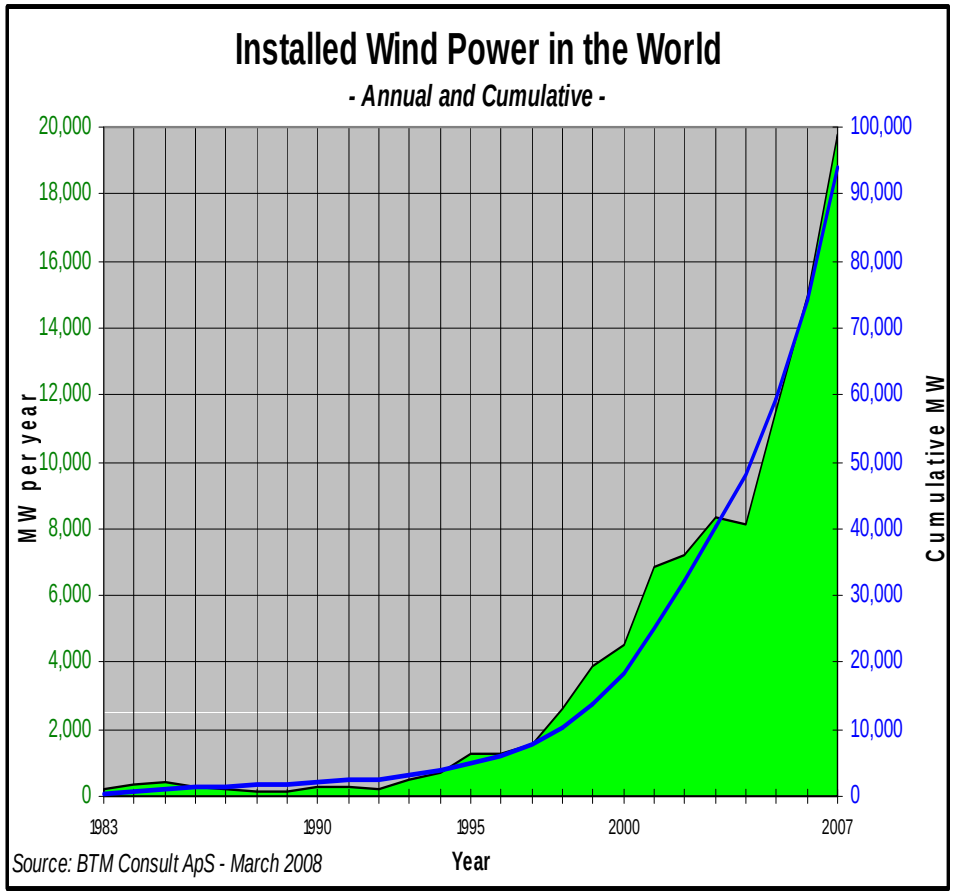
Risø DTU
National Laboratory for Sustainable Energy

Development

- Up-scaling by x100, from 50 to 5000 kW in 20 years
- Nearly the same concept
- From fixed blades (stall) to pitch
- 61.5 m blades for 5000 kW turbines
- Cost reduction with x3
- 20 % electricity from wind in DK



World market



GLOBAL STATUS

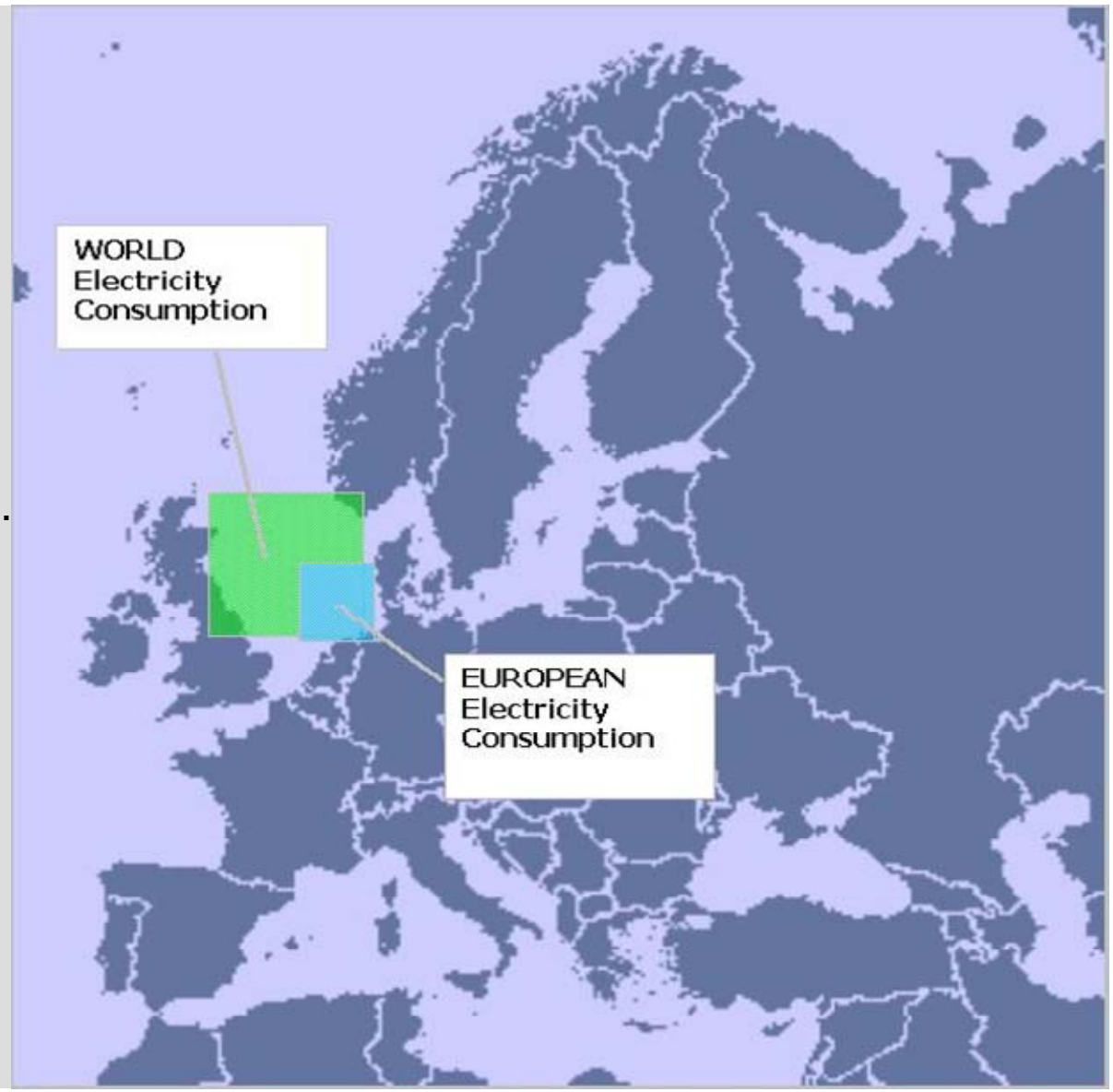
- 94 GW installed in total
- ~1% offshore
- 1.01 % of global electricity
- Wind power growing 27% per year
- Installed power doubles every 3 years

- Goal 2020: 12 %, 1200 GW

Wind energy as base load

Integration is the challenge.
- -Electric cars (V2G)
- -Pumped storage

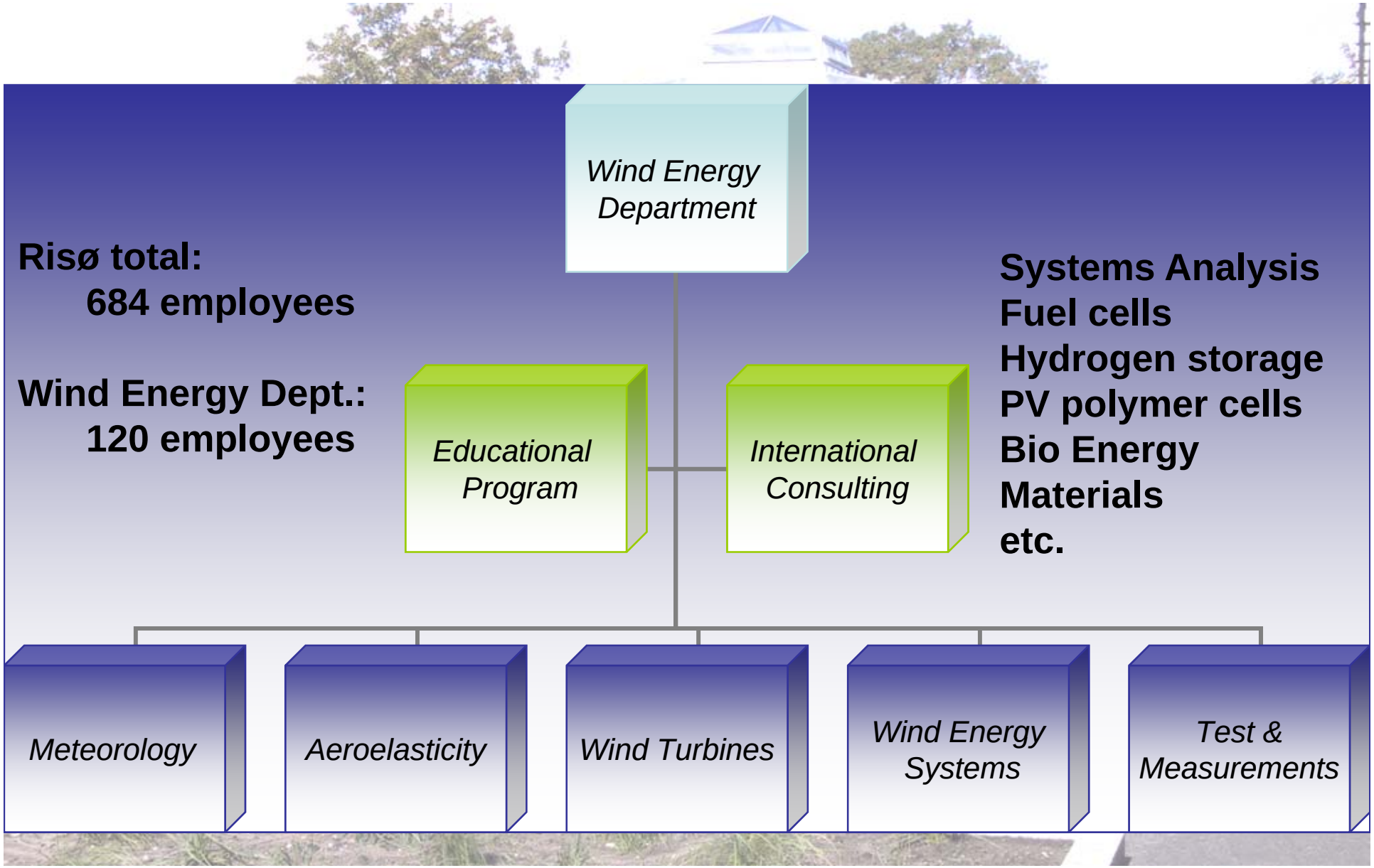
Norway:
- 25 GW Hydro power.
- ~2 GW pumped storage.
- Potentials for more



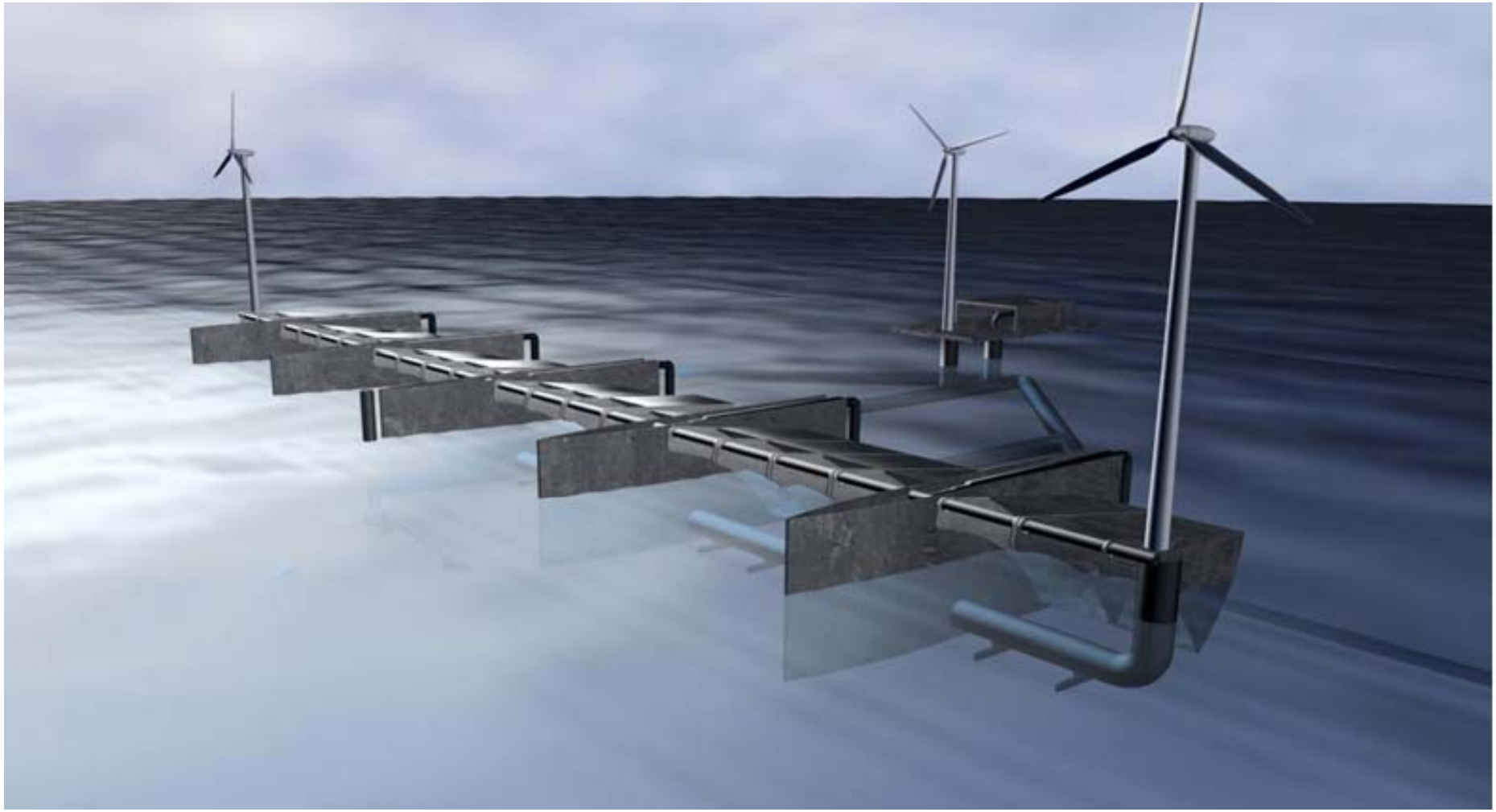
Introduction to Risø DTU

- **1958** Inaugurated. Purpose: Peaceful utilisation of nuclear energy
- **1976** Oil crises (1973) results in research in other Energy sources
- **1978** Research in Wind Energy starts
- **1985** Political decision of not having nuclear energy in Denmark
- **1994** State-owned enterprise
- **2000** The last nuclear reactor is shut down
- **2007** Merger with DTU, the Danish Institute for Food and Veterinary Research, the Danish Institute for Fisheries Research, the Danish National Space Centre and the Danish Transport Research Institute

Introduction to Risø DTU



Off shore development



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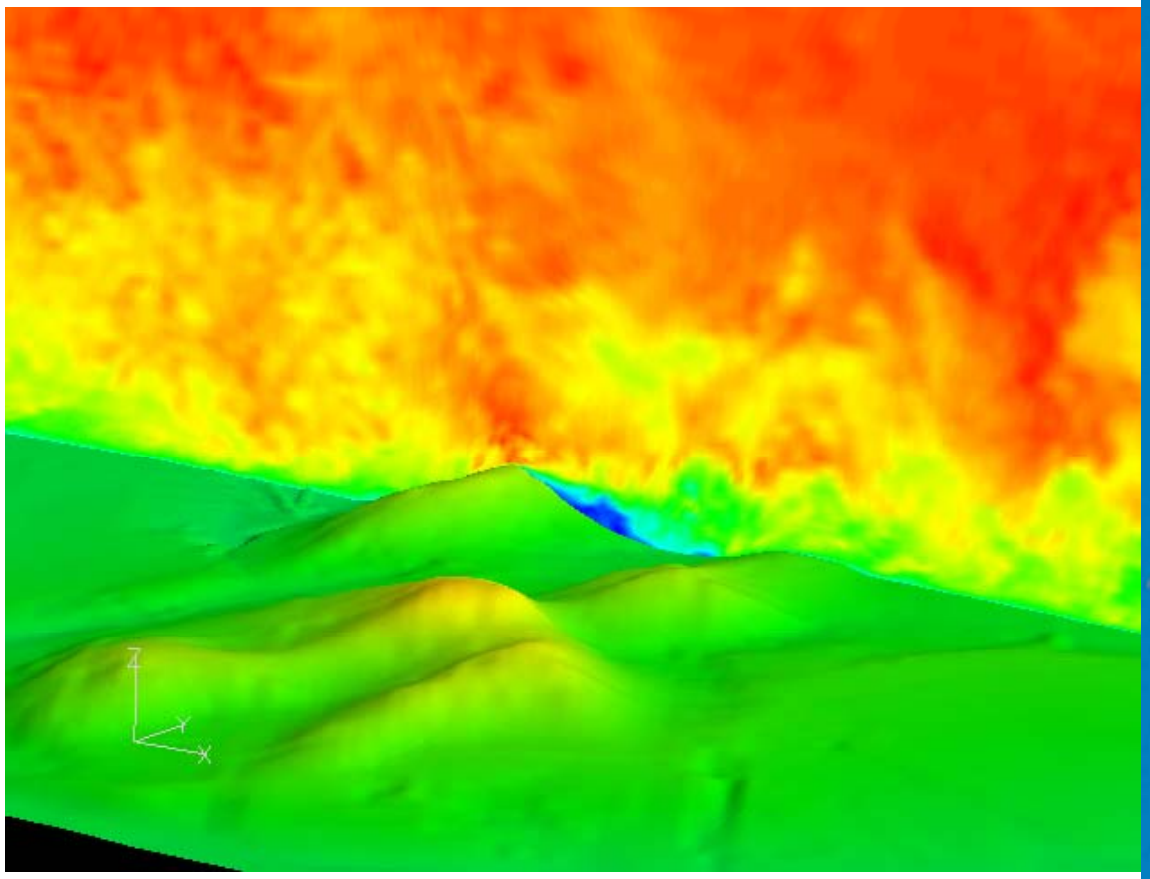
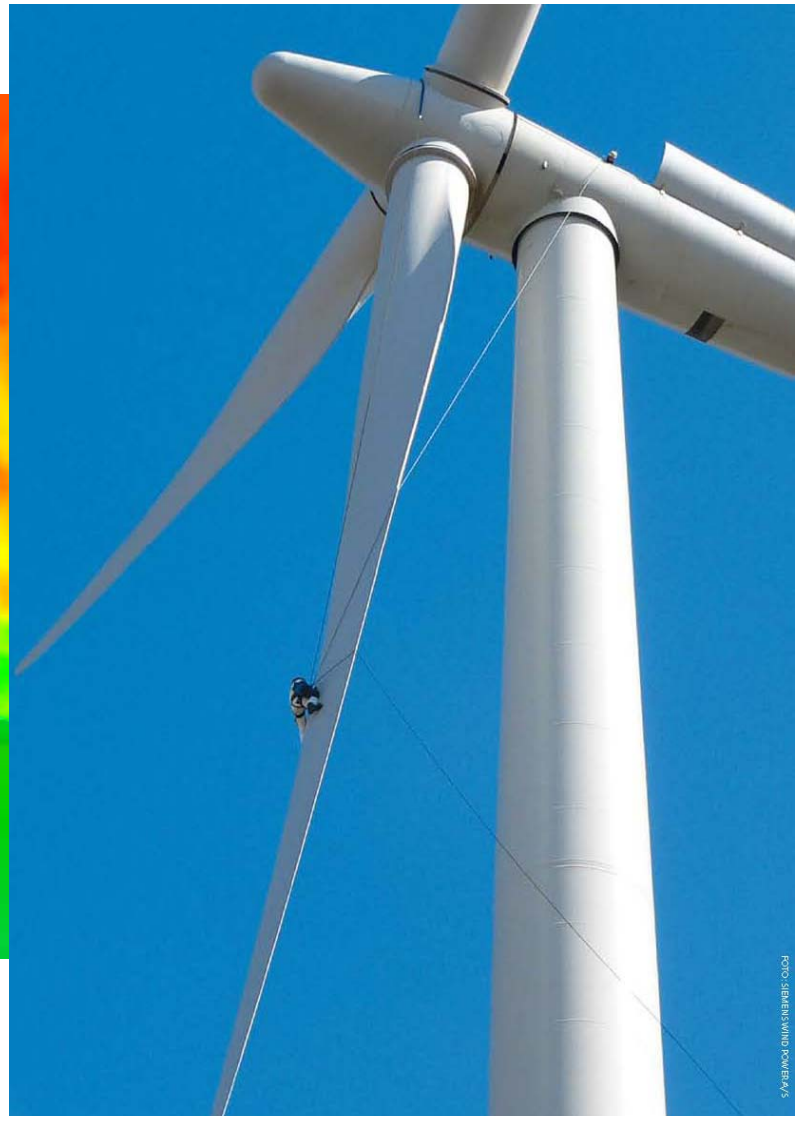
Problem



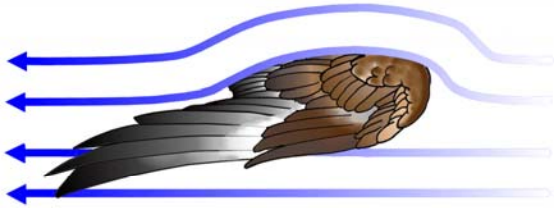


Wake turbulence in wind farms

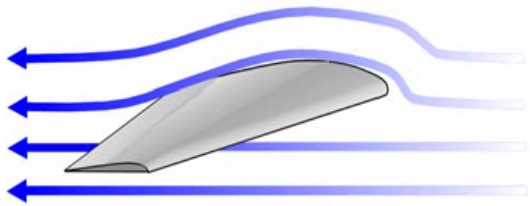
Adaptive trailing edges

From 2003 to today:
three large research projects
involving more than 10 researchers,
6 master thesis and 3 Ph.d's

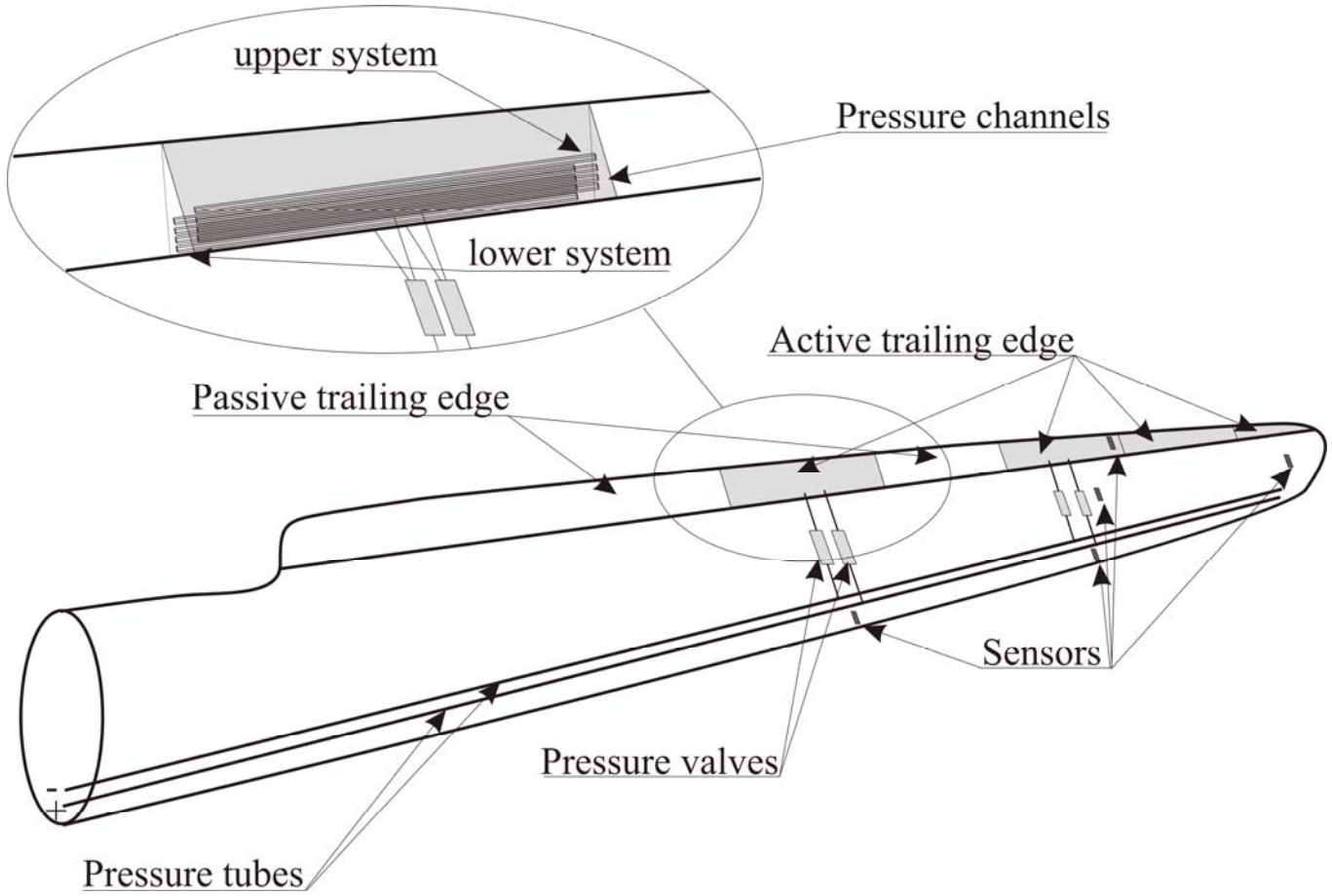
Inspiration



Not applicable!



Typical layout



Typical layout

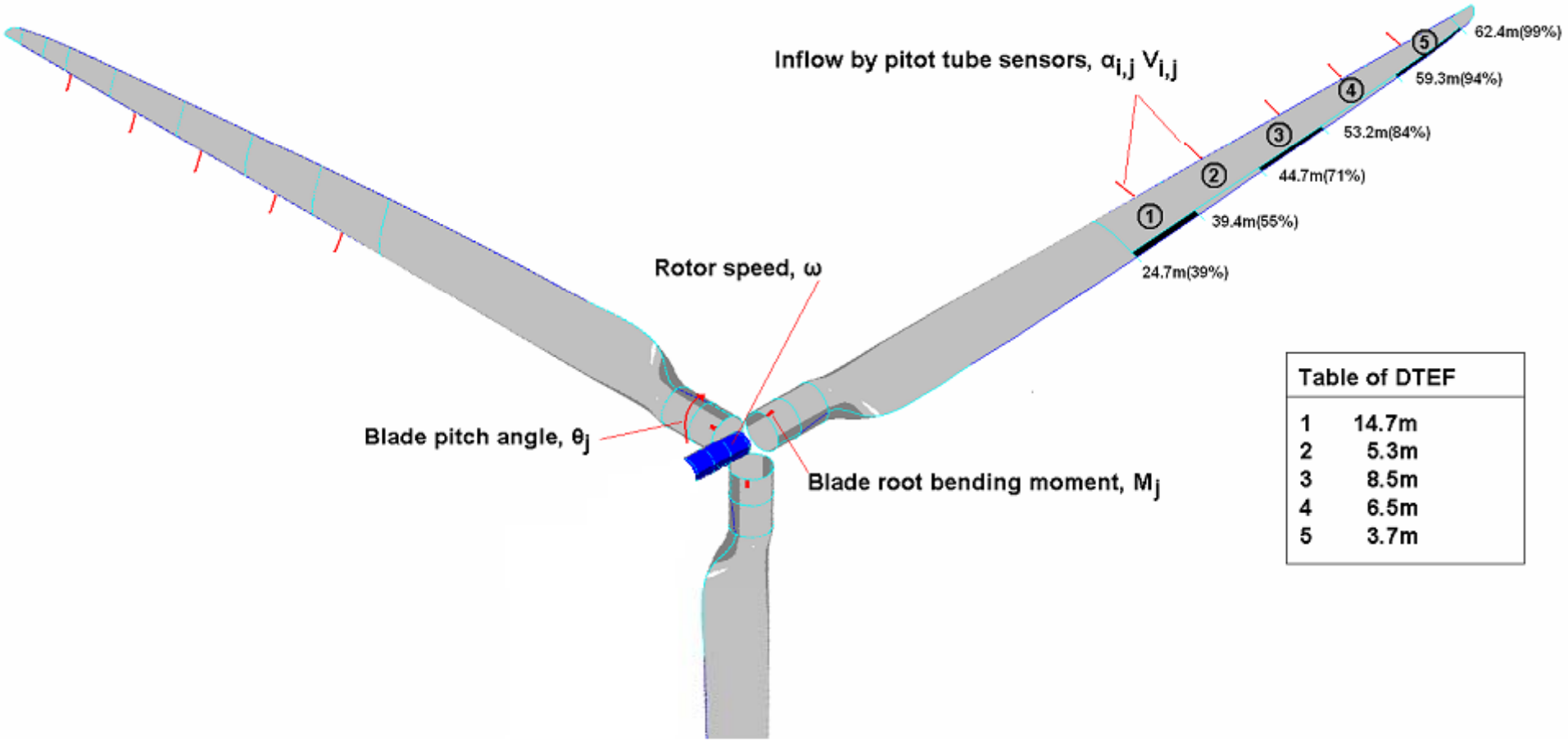
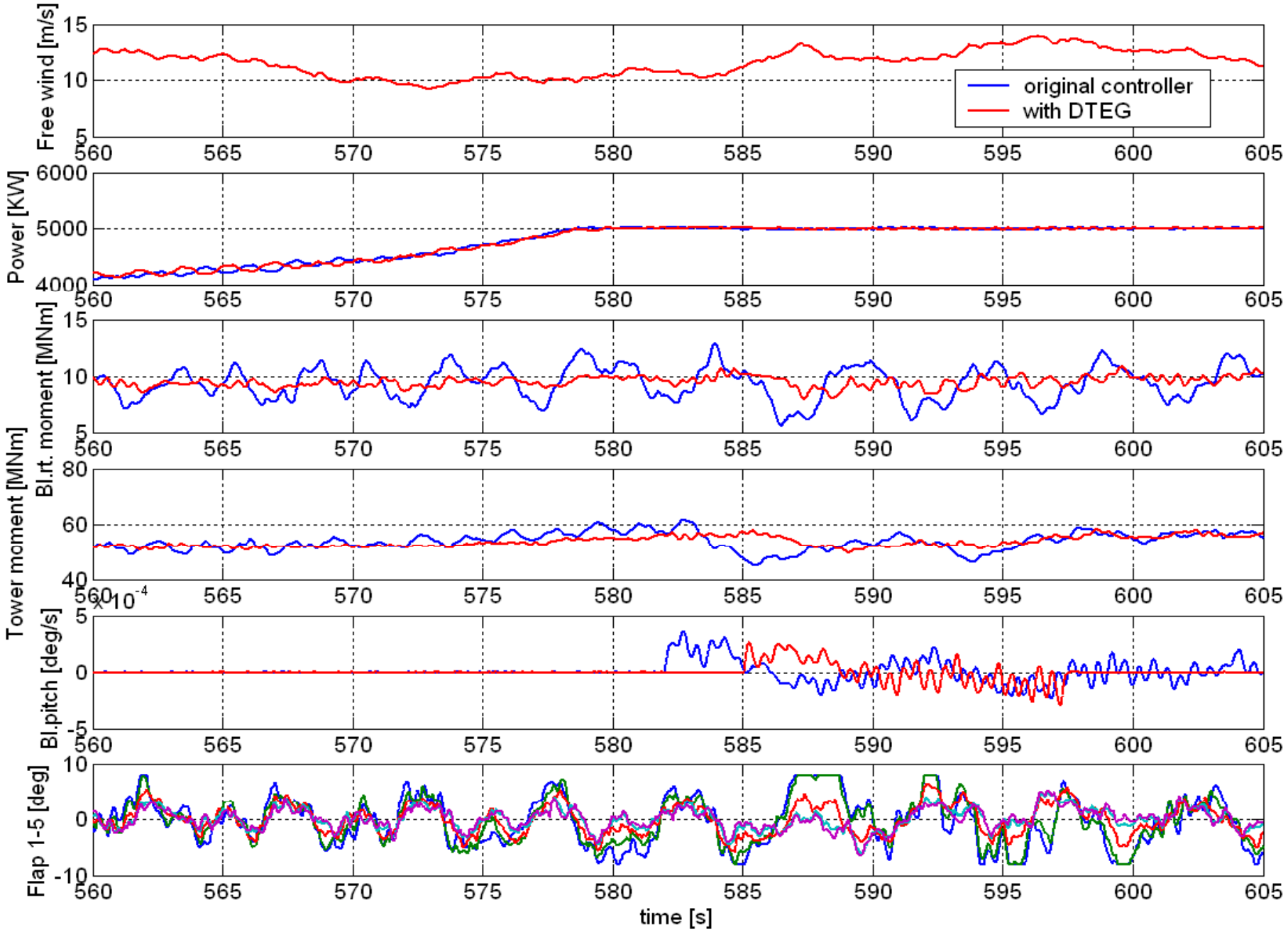
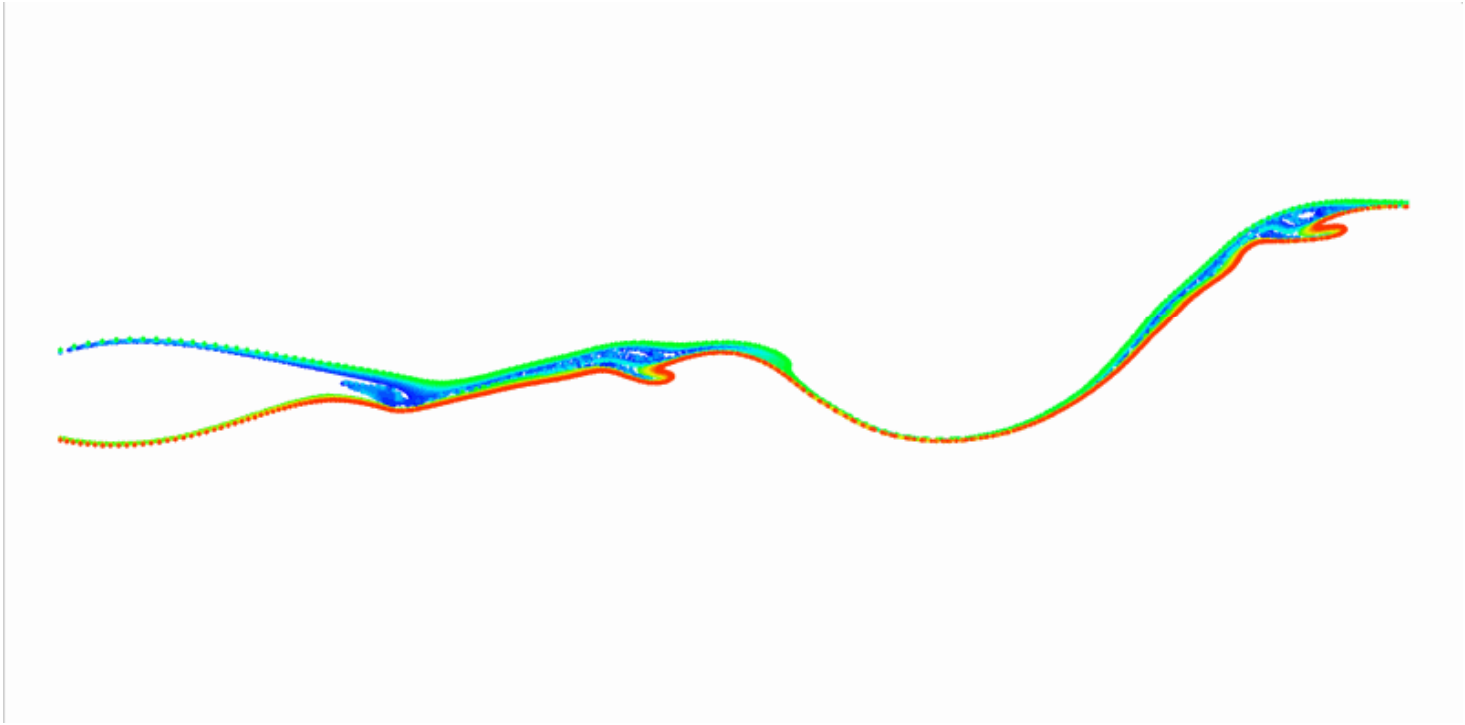


Table of DTEF	
1	14.7m
2	5.3m
3	8.5m
4	6.5m
5	3.7m

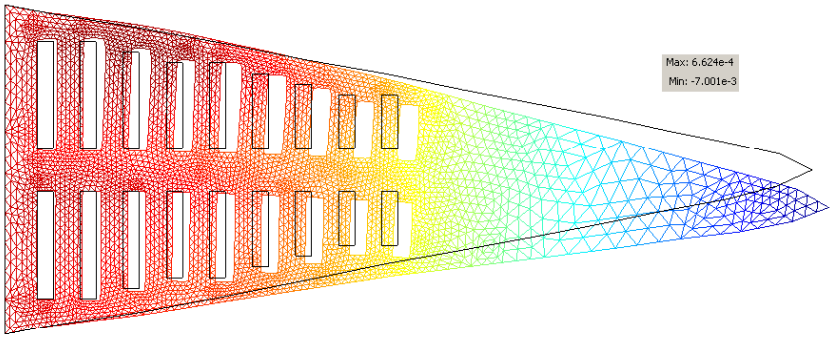
Numerical results

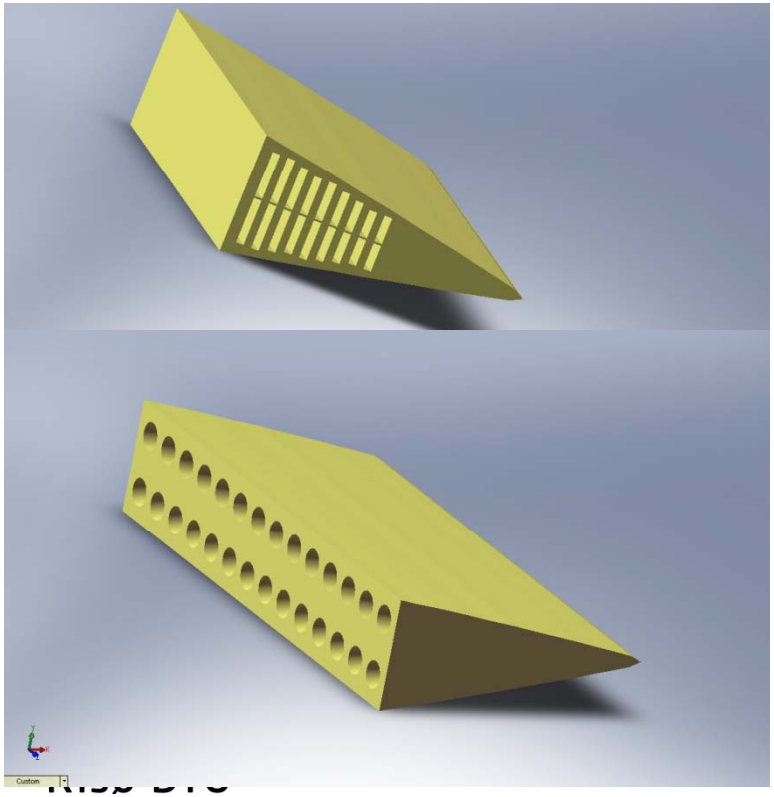


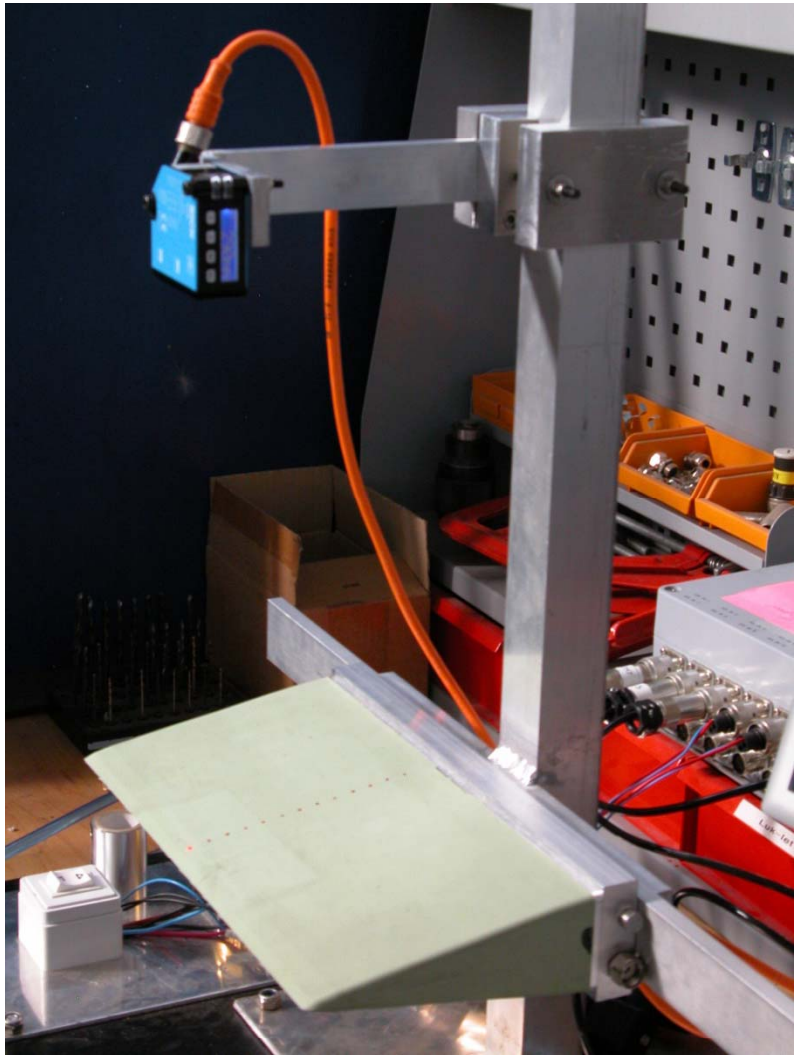
Animated flow



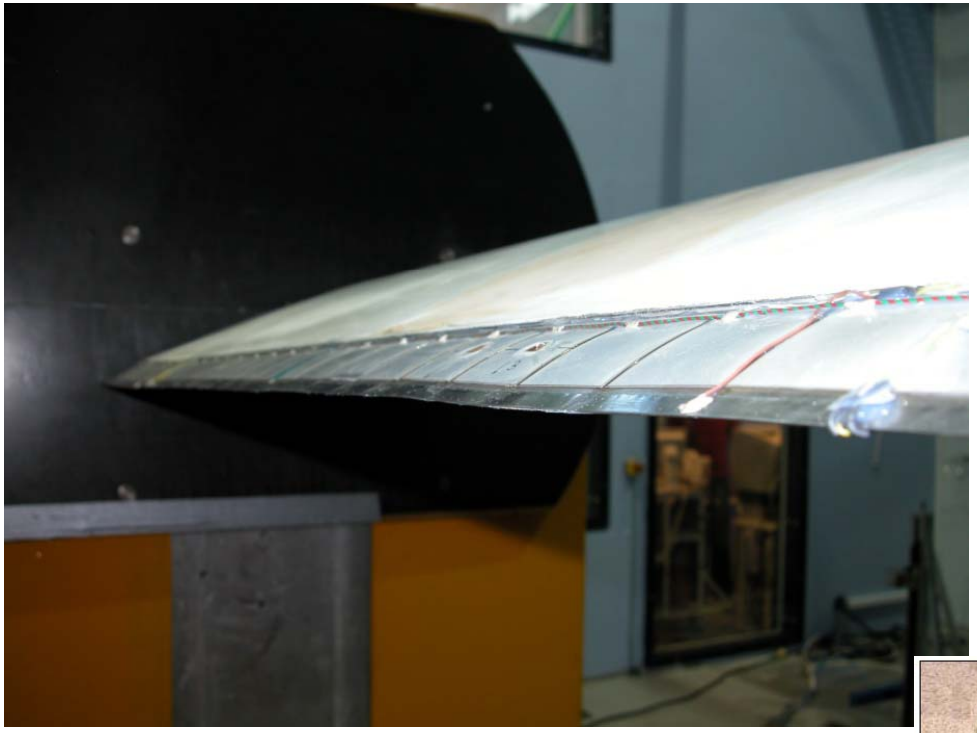
Rubber trailing edge

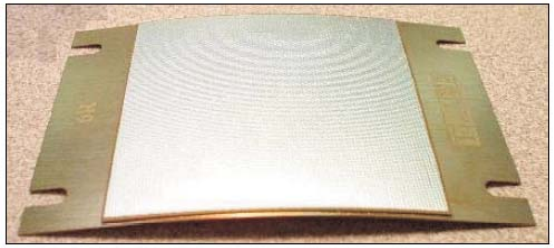






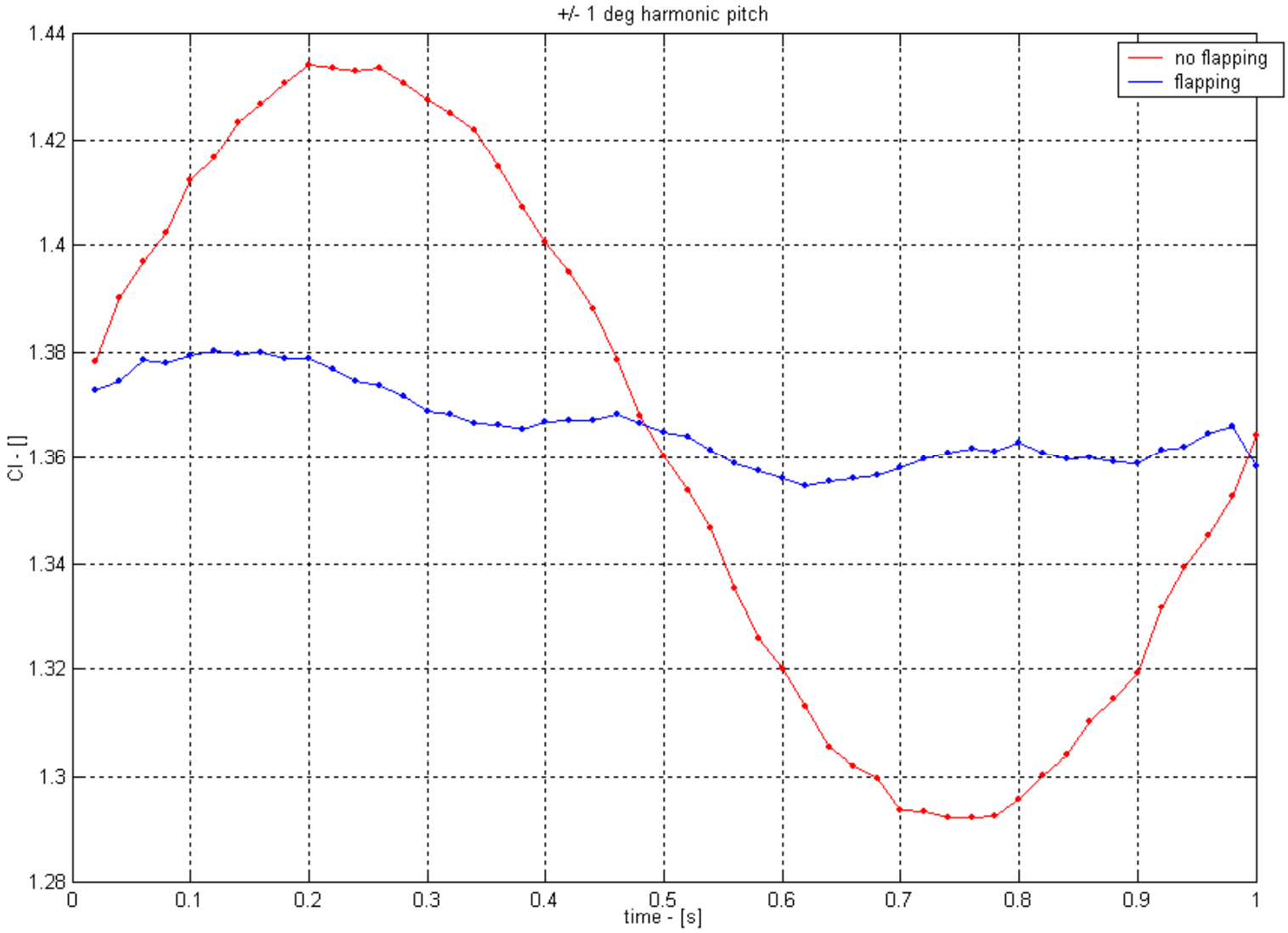
Wind tunnel test – piezo electrical material



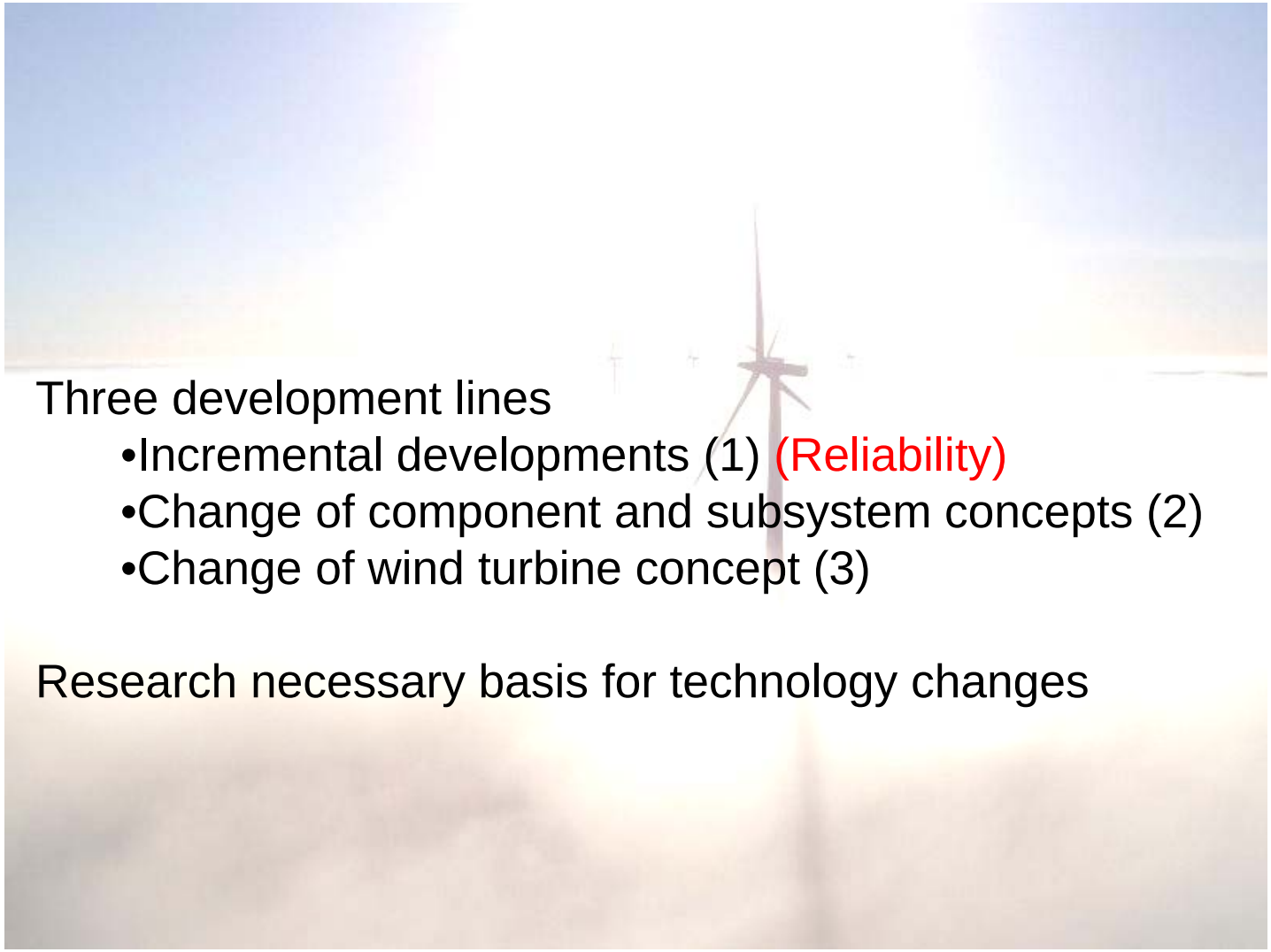


Wind tunnel test

Wind tunnel results



Where are the development potentials?



Three development lines

- Incremental developments (1) (Reliability)
- Change of component and subsystem concepts (2)
- Change of wind turbine concept (3)

Research necessary basis for technology changes